FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003
SAR EVALUATION REPORT
(WiMAX PORTION)

FOR

Intel® Centrino® Advanced-N + WiMAX 6250
(Tested inside of Lenovo TP00019A)

MODEL: 622ANXHMW

FCC ID: PD9622ANXHU

REPORT NUMBER: 10U13597-2B

ISSUE DATE: March 23, 2011

Prepared for

INTEL CORPORATION
2111 N.E. 25TH AVENUE
HILLSBORO, OR 97124, USA

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	March 2, 2011	Initial Issue	--
A	March 16, 2011	Correct host model number and add Bluetooth collocation justification statement on page 9	S.Shih
B	March 23, 2011	Additional test for Secondary Portrait configuration.	S. Shih

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1. ATTESTATION OF TEST RESULTS

Company name:	INTEL CORPORATION 2111 N.E. 25TH AVENUE HILLSBORO, OR 97124, USA
EUT Description:	Intel® Centrino® Advanced-N + WiMAX 6250 (Tested inside of Lenovo TP00019A)
Model number:	622ANXHMW
Device Category:	Portable
Exposure category:	General Population/Uncontrolled Exposure
Date of tested:	February 9-11, 2011 March 22, 2011 (Additional testing for Secondary portrait)

FCC rule part	Freq. range (MHz)	Highest 1-g SAR (W/kg)	Limit (W/kg)
27	2498.5 – 2687.5	0.554 W/kg (5 MHz_QPSK) Edge - Secondary Landscape	1.6

Applicable Standards	Test Results
FCC OET Bulletin 65 Supplement C 01-01 and the following test procedures: - KDB 615223 802.16e WiMax SAR Guidance - KDB 616217 Laptop with Screen Ant - 447498 D01 Mobile Portable RF Exposure v04	Pass

Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For UL CCS By:

Sunny Shih
Engineering Team Leader
Compliance Certification Services (UL CCS)

Tested By:

Devin Chang
EMC Engineer
Compliance Certification Services (UL CCS)

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01 and the following specific FCC test procedures:

- KDB 615223 D01 802.16e WiMax SAR Guidance v01
- KDB 616217 D01 Laptop with Screen Ant v01r01
- KDB 616217 D02 SAR Polcy with Screen Ant v01r01
- KDB 616217 D03 SAR Supp Note and Netbook Laptop v01
- 447498 D01 Mobile Portable RF Exposure v04

2a. Control Signal Description

During normal operation of the Intel 6250 as a mobile WiMAX system the control channels may occupy up to 5 slots. A slot is a sub-channel with the duration of 3 symbols A maximum of two simultaneous Fast Channel Feedback (CQICH) reports used to feedback channel state information are possible, which can occupy up to two slots. A maximum of three slots can be used for Hybrid Automatic Repeat Request (HARQ) ACK/NAK by the five possible DL HARQ bursts in the previous DL frame. The 5 ACK/NAK bits each occupy ½ slot.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
E-Field Probe	SPEAG	EX3DV4	3686	1	24	2012
Data Acquisition Electronics	SPEAG	DAE4	1239	11	11	2011
System Validation Dipole	SPEAG	D2600V2	1006	4	22	2009
Simulating Liquid	SPEAG	MSL2600	N/A	Within 24 hrs of first test		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
ESG Vector Signal Generator	Agilent	E4438C	US44271971	9	28	2011
Dielectric Probe Kits	Agilent	85070E	2569	N/A		
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
Thermometer	ERTCO	639-1S	1718	7	19	2011
Power Meter	Giga-tronics	8651A	8651404	3	13	2012
Power Sensor	Giga-tronics	80701A	1834588	3	13	2012
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		

*** Note:** Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in UL CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in UL CCS)

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	5.50	Normal	1	1	5.50
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement (Body 2600 MHz)	2.46	Normal	1	0.64	1.57
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty (Body 26000 MHz)	-1.48	Normal	1	0.6	-0.89
Combined Standard Uncertainty Uc(y) =					9.61
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.22	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.53	dB

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5. EQUIPMENT UNDER TEST

Intel® Centrino® Advanced-N + WiMAX 6250.

Model number: 622ANXHMW (Tested inside of Lenovo TP00019A)

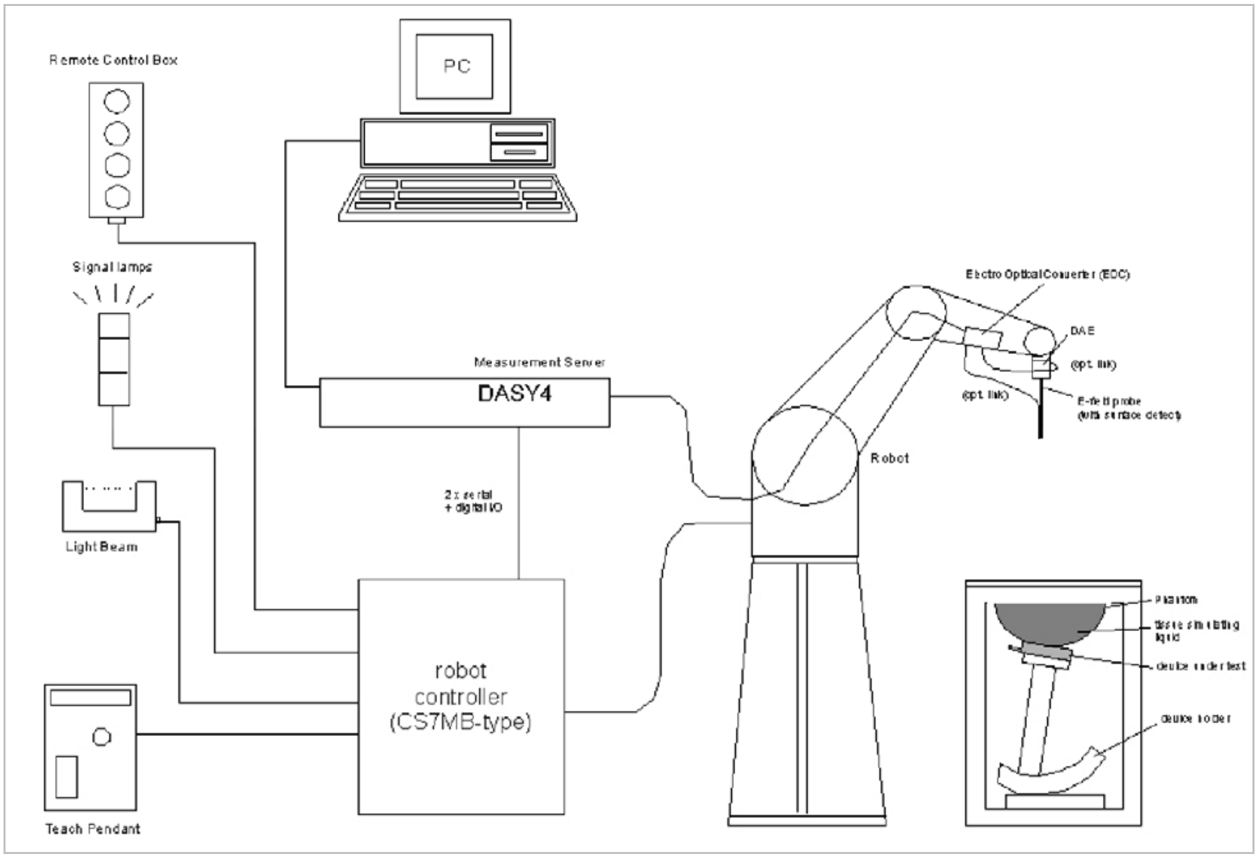
Intel® Centrino® Advanced-N + WiMAX 6250 is an embedded IEEE 802.16e and 802.11a/b/g/n wireless network adapter that operates in the 2.4 GHz and 5 GHz spectra for WiFi and 2.6 GHz for WiMAX. The adapter is installed inside the Lenovo TP00019A. This adapter is capable of delivering up to 300 Mbps Tx/Rx over WiFi and up to 4 Mbps UL/10 Mbps DL over WiMAX.

WiMAX and 802.11 a/b/g/n co-location conditions:

The 802.16e WiMAX and 802.11 a/b/g/n WiFi radio will not transmit simultaneously. When the 622ANXHMW is installed in the typical laptop computer, once the network is chosen by the end user during WiMAX/WiFi network, only the WiMAX radio or WiFi radio will transmit.

Normal operation:	o Laptop mode (with display open at 90° to the keyboard) o bottom face, and o edges: - Multiple display orientations supporting both portrait and landscape configurations
Antenna tested:	Manufactured / Part number Yageo Corp. / Main (A) Antenna: 25.90A1E.011
Antenna-to-antenna/user separation distances:	See Section 20 for details of antenna locations and separation distances
Assessment for SAR evaluation for Simultaneous transmission:	**WiMAX – WLAN** The 802.16e WiMAX and 802.11a/b/g/n WiFi radio will not transmit simultaneously. **WiMAX – Bluetooth** Simultaneous Bluetooth SAR evaluation is not necessary due to the BT power < 60/f and WiMAX antenna-to-Bluetooth antenna distance = 109.5mm."

6. SYSTEM DESCRIPTION



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

7. COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)										
	450		835		915		1900		2450		2600
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04	0.05
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7	27.2
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78	2.16

Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

8. SIMULATING LIQUID DIELECTRIC PARAMETERS

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to 2 GHz, the measured conductivity and relative permittivity should be within ± 5% of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within ± 5% of the target values. The measured relative permittivity tolerance can be relaxed to no more than ± 10%.

Reference Values of Tissue Dielectric Parameters for Body Phantom

The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

Target Frequency (MHz)	Body	
	ε_r	σ (S/m)
2450	52.7	1.95
2500	52.6	2.02
2600	52.5	2.16
2690	52.4	2.29

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

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8.1. SIMULATING LIQUID CHECK RESULTS

Simulating Liquid Dielectric Parameter Check Result @ Body 2600 MHz Measured by: Devin Chang

Simulating Liquid		Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Depth (cm)							
2500	15	e'	52.2281	Relative Permittivity (ϵ_r):	52.2281	52.6	-0.71	± 5
		e''	14.6546	Conductivity (σ):	2.03814	2.02	0.90	± 5
2590	15	e'	51.9260	Relative Permittivity (ϵ_r):	51.9260	52.5	-1.09	± 5
		e''	15.0031	Conductivity (σ):	2.16172	2.15	0.55	± 5
2600	15	e'	51.8932	Relative Permittivity (ϵ_r):	51.8932	52.5	-1.18	± 5
		e''	15.0428	Conductivity (σ):	2.17581	2.16	0.69	± 5
2690	15	e'	51.5704	Relative Permittivity (ϵ_r):	51.5704	52.4	-1.58	± 5
		e''	15.3942	Conductivity (σ):	2.30371	2.29	0.60	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 39%
February 09, 2011 01:48 PM

Frequency	e'	e''
2450000000.	52.4022	14.4624
2460000000.	52.3683	14.4998
2470000000.	52.3344	14.5367
2480000000.	52.2974	14.5768
2490000000.	52.2653	14.6172
2500000000.	**52.2281**	**14.6546**
2510000000.	52.1942	14.6937
2520000000.	52.1616	14.7311
2530000000.	52.1289	14.7700
2540000000.	52.0970	14.8090
2550000000.	52.0633	14.8453
2560000000.	52.0307	14.8859
2570000000.	51.9983	14.9217
2580000000.	51.9620	14.9612
2590000000.	**51.9260**	**15.0031**
2600000000.	**51.8932**	**15.0428**
2610000000.	51.8590	15.0843
2620000000.	51.8258	15.1232
2630000000.	51.7908	15.1616
2640000000.	51.7552	15.1999
2650000000.	51.7221	15.2389
2660000000.	51.6858	15.2770
2670000000.	51.6471	15.3155
2680000000.	51.6080	15.3607
2690000000.	**51.5704**	**15.3942**
2700000000.	51.5282	15.4478
2710000000.	51.4937	15.4746
2720000000.	51.4559	15.5074
2730000000.	51.4194	15.5443

The conductivity (σ) can be given as:

$\sigma = \omega\varepsilon_0 e'' = 2\pi f \varepsilon_0 e''$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Simulating Liquid Dielectric Parameter Check Result @ Body 2600 MHz Measured by: Devin Chang

Simulating Liquid		Parameters			Measured	Target	Deviation (%)	Limit (%)
f (MHz)	Depth (cm)							
2500	15	e'	51.8195	Relative Permittivity (ϵ_r):	51.8195	52.6	-1.48	± 5
		e"	14.8822	Conductivity (σ):	2.06979	2.02	2.46	± 5
2590	15	e'	51.4693	Relative Permittivity (ϵ_r):	51.4693	52.5	-1.96	± 5
		e"	15.2203	Conductivity (σ):	2.19302	2.15	2.00	± 5
2600	15	e'	51.4338	Relative Permittivity (ϵ_r):	51.4338	52.5	-2.05	± 5
		e"	15.2578	Conductivity (σ):	2.20691	2.16	2.13	± 5
2690	15	e'	51.0914	Relative Permittivity (ϵ_r):	51.0914	52.4	-2.50	± 5
		e"	15.5976	Conductivity (σ):	2.33415	2.29	1.93	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 39%
February 10, 2011 11:14 AM

Frequency	e'	e"
2450000000.	52.0127	14.6776
2460000000.	51.9767	14.7192
2470000000.	51.9376	14.7624
2480000000.	51.8949	14.8017
2490000000.	51.8571	14.8414
2500000000.	**51.8195**	**14.8822**
2510000000.	51.7808	14.9201
2520000000.	51.7428	14.9596
2530000000.	51.7057	14.9952
2540000000.	51.6658	15.0308
2550000000.	51.6267	15.0702
2560000000.	51.5869	15.1036
2570000000.	51.5455	15.1448
2580000000.	51.5067	15.1790
2590000000.	**51.4693**	**15.2203**
2600000000.	**51.4338**	**15.2578**
2610000000.	51.3989	15.2960
2620000000.	51.3664	15.3329
2630000000.	51.3311	15.3675
2640000000.	51.2922	15.4088
2650000000.	51.2539	15.4458
2660000000.	51.2134	15.4814
2670000000.	51.1699	15.5196
2680000000.	51.1308	15.5565
2690000000.	**51.0914**	**15.5976**
2700000000.	51.0553	15.6362
2710000000.	51.0185	15.6768
2720000000.	50.9814	15.7150
2730000000.	50.9470	15.7513

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
3/22/2011	Body 2500	e'	52.2683	Relative Permittivity (ϵ_r):	52.27	52.64	-0.70	5
		e"	14.5071	Conductivity (σ):	2.02	2.02	-0.18	5
3/22/2011	Body 2590	e'	51.9305	Relative Permittivity (ϵ_r):	51.93	52.52	-1.13	5
		e"	14.9312	Conductivity (σ):	2.15	2.15	0.16	5
3/22/2011	Body 2600	e'	51.9037	Relative Permittivity (ϵ_r):	51.90	52.51	-1.16	5
		e"	14.9669	Conductivity (σ):	2.16	2.16	0.14	5
3/22/2011	Body 2690	e'	51.5538	Relative Permittivity (ϵ_r):	51.55	52.40	-1.61	5
		e"	15.3264	Conductivity (σ):	2.29	2.29	0.22	5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
March 22, 2011 08:40 PM

Frequency	e'	e"
2450000000.	52.4118	14.2886
2460000000.	52.3876	14.3587
2470000000.	52.3654	14.4150
2480000000.	52.3422	14.4654
2490000000.	52.2985	14.5133
2500000000.	**52.2683**	**14.5071**
2510000000.	52.2445	14.5612
2520000000.	52.2154	14.5853
2530000000.	52.1654	14.6252
2540000000.	52.1265	14.6505
2550000000.	52.0860	14.7060
2560000000.	52.0540	14.7415
2570000000.	52.0239	14.8104
2580000000.	51.9794	14.8843
2590000000.	**51.9305**	**14.9312**
2600000000.	**51.9037**	**14.9699**
2610000000.	51.8696	15.0007
2620000000.	51.8434	15.0248
2630000000.	51.8265	15.0382
2640000000.	51.7760	15.0609
2650000000.	51.7511	15.1010
2660000000.	51.7041	15.1437
2670000000.	51.6479	15.2023
2680000000.	51.6074	15.2569
2690000000.	**51.5538**	**15.3264**
2700000000.	51.5185	15.3594
2710000000.	51.4975	15.3924
2720000000.	51.4789	15.4211
2730000000.	51.4573	15.4482
2740000000.	51.4328	15.4603
2750000000.	51.4033	15.4768

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target $f * 10^6$

$\varepsilon_0 = 8.854 * 10^{-12}$

9. SYSTEM VERIFICATION

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of ±10%.

Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV3 SN3531 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System validation dipole	Cal. certificate #	Cal. date	SAR Avg (mW/g)		
			Tissue:	Head	Body
D2600V2	D2600V2-1006_Apr09	4/22/09	SAR_{1g}:		57.6
			SAR_{10g}:		25.8

9.1. SYSTEM PERFORMANCE CHECK RESULTS

Ambient Temperature = 24°C; Relative humidity = 39% Measured by: David Lee

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2600V2	02/09/11	SAR_{1g}:	55.2	57.6	-4.17	±10
		SAR_{10g}:	23.8	25.8	-7.75	
D2600V2	02/10/11	SAR_{1g}:	56.4	57.6	-2.08	±10
		SAR_{10g}:	24.5	25.8	-5.04	
D2600V2	03/22/11	SAR_{1g}:	55.8	57.6	-3.13	±10
		SAR_{10g}:	24.2	25.8	-6.20	

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10. RF OUTPUT POWER VERIFICATION

The maximum conducted output power is measured for the uplink burst in the difference modulation and channel bandwidth. The output power is measured for the uplink bursts through triggering and gating.

Mode		Test Vector file name	Freq.	Conducted output power	
			(MHz)	(dBm)	(mW)
5MHz	QPSK	DQ64_56_UQ4_12_5M	2498.5	22.10	162.18
			2593.0	**22.20**	165.96
			2687.5	22.10	162.18
5MHz	16QAM	DQ4_12_UQ16_34_5M	2498.5	22.40	173.78
			2593.0	**22.40**	173.78
			2687.5	22.10	162.18
5MHz	64QAM	DQ4_12_UQ64_56_5M	2498.5	21.90	154.88
			2593.0	**21.90**	154.88
			2687.5	21.90	154.88
10MHz	QPSK	DQ64_UQ4_12_21S_10M	2501.0	23.30	213.80
			2593.0	**22.90**	194.98
			2685.0	22.90	194.98
10MHz	16QAM	DQ4_12_UQ16_12_10M	2501.0	22.90	194.98
			2593.0	**23.20**	208.93
			2685.0	22.80	190.55
10MHz	64QAM	DQ4_12_UQ64_56_10M	2501.0	20.50	112.20
			2593.0	**20.50**	112.20
			2685.0	20.50	112.20

11. PEAK TO AVERAGE RATIO

Peak and Average Output power measurements were made with Power Meter.

Mode	Test Vector file name	Ch. No	f (MHz)	Conducted Power (dBm)		Peak-to-average ratio (PAR)
				Peak	Average	
QPSK	DQ64_56_UQ4_12_5M	378	2593	30.00	22.20	7.80
16QAM	DQ4_12_UQ16_34_5M	378	2593	31.09	22.40	8.69
64QAM	DQ4_12_UQ64_56_5M	378	2593	29.06	21.90	7.16
QPSK	DQ64_UQ4_12_21S_10M	368	2593	31.90	22.90	9.00
16QAM	DQ4_12_UQ16_12_10M	368	2593	32.08	23.20	8.88
64QAM	DQ4_12_UQ64_56_10M	368	2593	29.15	20.50	8.65

12. WIMAX / 802.16e DEVICE SPECIFICATION

12.1. WiMAX Zone Types

The device and its system are both transmitting using only PUSC zone type. This enables multiple users to transmit simultaneously within the system. FUSC, AMC and other zone types are not used by WiMAX 6250 for uplink transmission. The maximum DL:UL symbol ratio can be determined according to the PUSC requirements. The system transmit an odd number of symbols using DL-PUSL consisting of even multiples of traffics and control symbols plus one symbol for the preamble. Multiples of three symbols are transmitted by the device using UL-PUSC. The OFDMA symbol time allows up to 48 downlink and uplink symbols in each 5 ms frame. TTG and RTG are also included in each frame as DL/UL transmission gaps; therefore, the system can only allow 47 or less symbols per frame. The maximum DL:UL symbol ratio is determined according to these PUSC parameters for evaluating SAR compliance.

WiMAX chipset is capable of supporting the following Downlink / Uplink based upon 802.16e.

Description	Down Link	Up Link
Number of OFDM Symbols in Down Link and Up Link for 5 MHz and 10 MHz Bandwidth	**35**	**12**
	34	13
	32	**15**
	31	16
	30	17
	29	**18**
	28	19
	27	20
	26	**21**

12.2. DUTY FACTOR CONSIDERATIONS

a. All Test Vector are performing with all UL symbols at maximum power.

b. Although the chipset can supply higher downlink-to-uplink (DL/UL) symbol ratios, SAR values are scaled up or down based upon BRS/EBS WiMAX operators with agreements to transmit at a maximum DL/UL symbol ratio of 29:18 Vs actual UL traffic symbols were used during SAR measurement. Therefore, the maximum transmission duty factor supported by the chipset is not applicable for this device. The system can transmit up to 48 OFDMA symbols in each 5 ms frame, including 1.6 symbols for TTG and RTG.

c. UL Burst Max. Average Power was measured using spectrum analyzer gated to measure the power only during Tx "On" stage.

Mode		Test Vector file name	Freq.	Conducted output power	
			(MHz)	(dBm)	(mW)
5 MHz	QPSK	DQ64_56_UQ4_12_5M	2593.0	22.20	165.96
	16QAM	DQ4_12_UQ16_34_5M	2593.0	22.40	173.78
	64QAM	DQ4_12_UQ64_56_5M	2593.0	21.90	154.88
10 MHz	QPSK	DQ64_UQ4_12_21S_10M	2593.0	22.90	194.98
	16QAM	DQ4_12_UQ16_12_10M	2593.0	23.20	208.93
	64QAM	DQ4_12_UQ64_56_10M	2593.0	20.50	112.20

d. The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 35 slots in the 10 MHz channel configuration

e. The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 17 slots in the 5 MHz channel configuration.

f. When the device is transmitting at max rated power, the output power for the control symbol and the target output power for UL:DL ratio of 29:18 is calculated as the following:

Waveform file	BW/Mode	DL:UL Ratio	DL:UL Ration SAR Scaling Factor
QD64_56_UQ4_12_5M	5MHz/QPSK	26:21	[(Max. Rated pwr*5/17*3)+Max. Rated pwr*15]/[Actual pwr*18]
DQ4_12_UQ16_34_5M	5MHz/16QAM	26:21	[(Max. Rated pwr*5/17*3)+Max. Rated pwr*15]/[Actual pwr*18]
DQ4_12_UQ64_36_5M	5MHz/64QAM	26:21	[(Max. Rated pwr*5/17*3)(Max. Rated pwr*15]/[Actual pwr*18]
DQ64_UQ4_12_21S_10M	10MHz/QPSK	23:24	[(Max. rated pwr*5/35*3)+max. rated pwr*15]/[Actual pwr*21]
DQ4_12_UQ16_12_10M	10MHz/16QAM	29:18	[(Max. rated pwr*5/35*3)+max. rated pwr*15]/[Actual pwr*15]
DQ4_12_UQ64_56_10M	10MHz/64QAM	23:24	[(Max. rated pwr*5/35*3)+max. rated pwr*15]/[Actual pwr*21]

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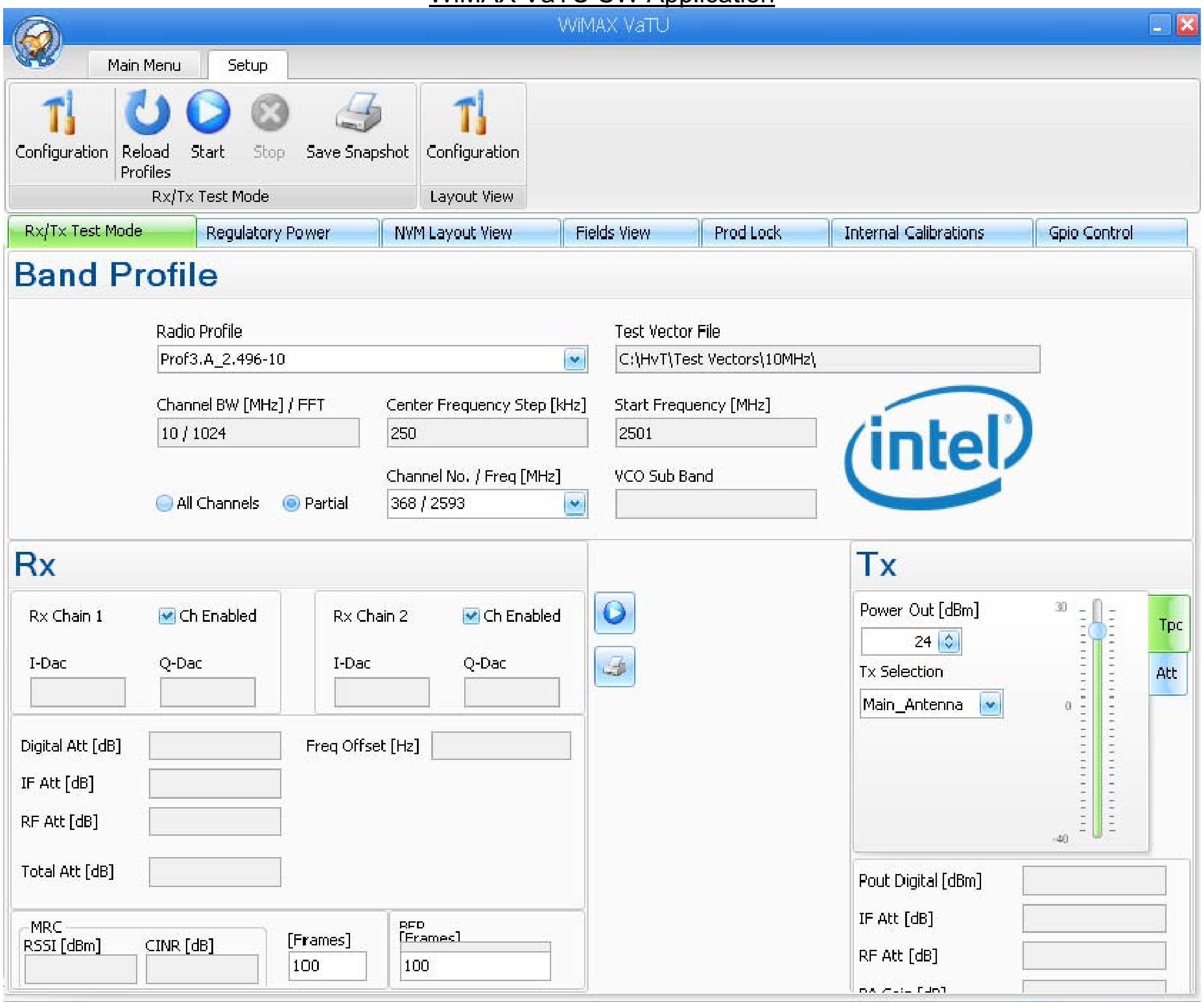
13. TEST SOFTWARE

The test software tool (WiMAX VaTU SW application) is installed on the host device, WiMAX , to transmit at max. output power. During normal operation, the output power of WiMAX client module is controlled by a WiMAX basestation, which also determines the characteristics of the transmission. For testing purposes, the device output power is kept at this max. using WiMAX VATU SW application loaded in the host device. The uplink transmission is maintained at a stable condition by the radio profile loaded in Vector signal generator. This enables the WiMAX module to transmit at max. power with a constant duty factor according to the specific radio profile. The test software serves only one purpose, to configure the WiMAX module to transmit at the max. power during SAR measurement.

The EUT driver software installed in the host support equipment during testing was WiMAX VaTU, version: 5.0.0.1

WiMAX VaTU SW Application

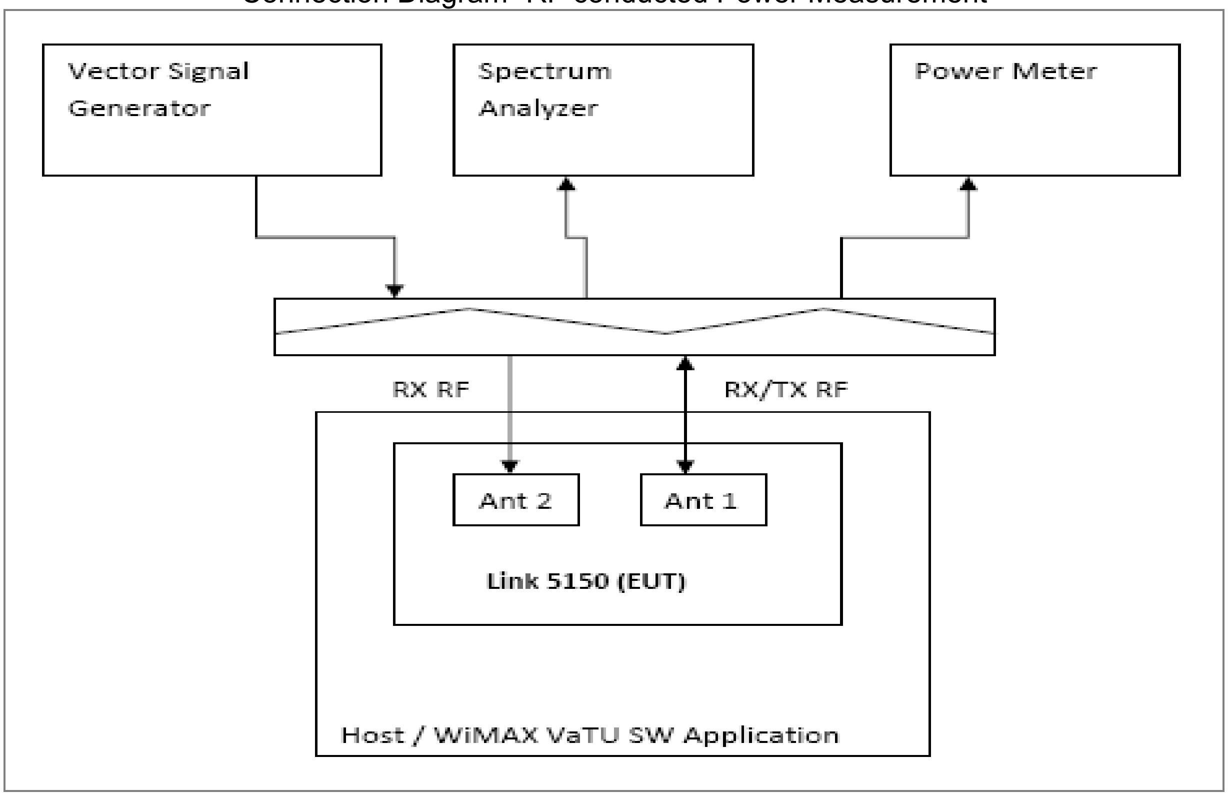


14. SIGNAL GENERATEOR DETAILS

Frame Profile loaded in Vector Signal Generator:

Waveform file	Ch. BW	Modulation	DL:UL Ration	Duty Cycle (Calculated)
QD64_56_UQ4_12_5M	5 MHz	QPSK	26:21	37.0%
DQ4_12_UQ16_34_5M	5 MHz	16QAM	26:21	37.0%
DQ4_12_UQ64_36_5M	5 MHz	64QAM	26:21	37.0%
DQ64_UQ4_12_21S_10M	10 MHz	QPSK	23:24	43.2%
DQ4_12_UQ16_12_10M	10 MHz	16QAM	29:18	30.9%
DQ4_12_UQ64_56_10M	10 MHz	64QAM	23:24	43.2%

Connection Diagram- RF conducted Power Measurement



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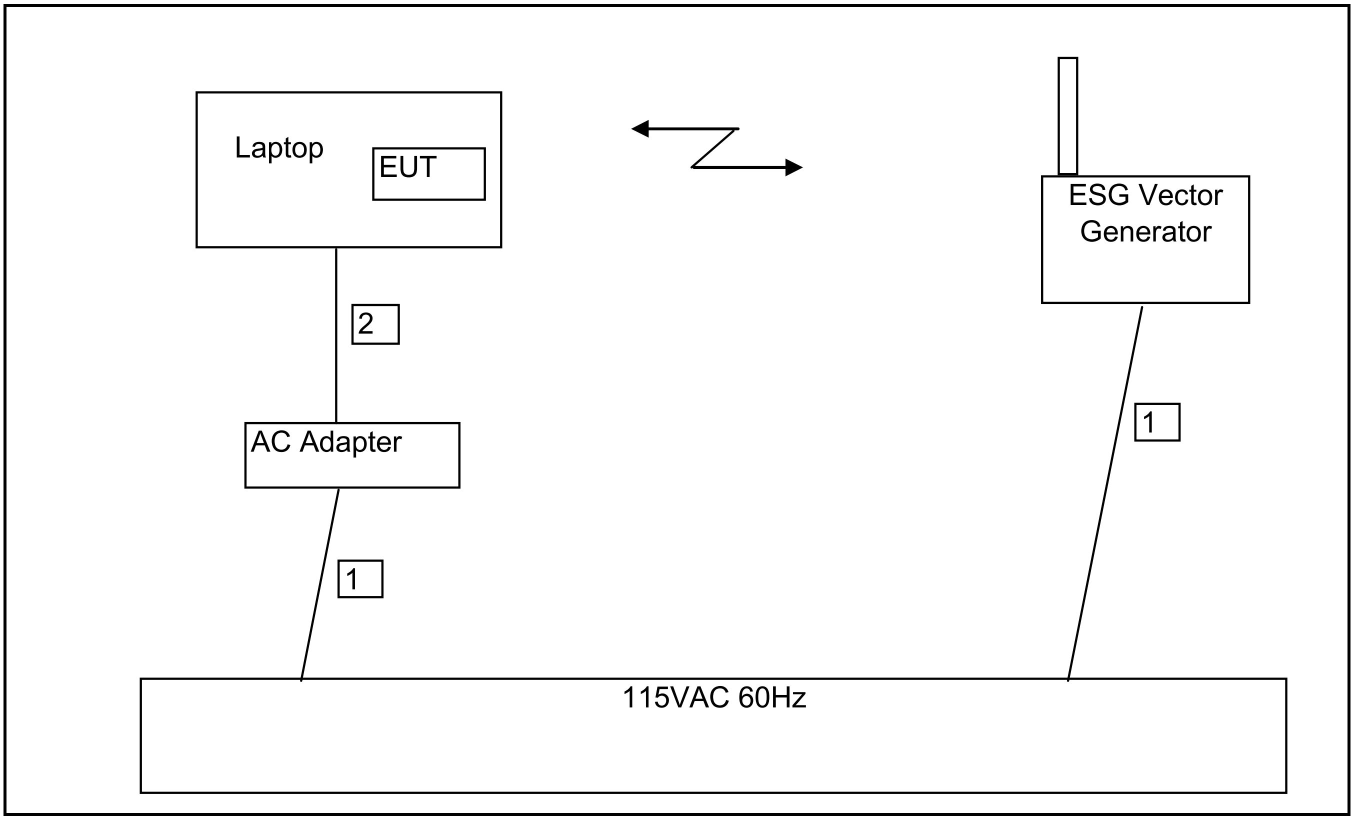
SAR Measurement



Agilent ESG Vector Signal Generator / Model:E4438C is used in conjunction with Intel supplied radio profile to configure the WiMAX module for the SAR evaluation. ESG Vector Signal Generator is loaded with the downlink signal, containing the respective FCH, DL-MAP and UL-MAP required by the test device to configure the uplink transmission. The waveform is configured for a DL:UL symbol ratio of 32:15 for 10 MHz/16WAM; 23:24 for 10MHz/QPSK and 26:21 for 5 MHz/16WAM/QPSK using Intel Signal Waveform Software for 802.16 WiMAX, on the PC and downloaded to the VSG. The test device can synchronize itself to the signal received from VSG, both in frequency and time. It then modulates the DL-MAP and UL-MAP transmitted in the downlink sub-frame and determine the DL:UL symbol ratio. The downlink burst is repeated in each frame, every 5 ms, to simulate the normal transmission from a WiMAX base station. The UL-MAP received by the device is used to configure the uplink burst with all data symbols and sub-channels active. Since this is a one-way communication configuration, control channel transmission is neither requested nor transmitted.

For TDD systems, both uplink and downlink transmissions are at the same frequency. The output power of the VSG is kept at least 80 dB lower than the test device to avoid interfering with the SAR measurements. In addition, a horn antenna is used for the VSG and it is kept more than 1 meter away from the test device to further minimize unnecessary pickup by the SAR probe.

15. VECTOR SIGNAL GENERATOR TEST SET DETAILS

Modulation and channel bandwidth selection is loaded to Vector Signal Generator. For example, when evaluating 16QAM with 10 MHz channel Bandwidth, radio profile name “DQ4_12_UQ16_12_10M “ is active on the Vector Signal Generator.

Parameter /Value	Frame definition for 10 MHz RCT		
	Test vector name		Remark
	DQ4_12_UQ16_12_10M	DQ64_UQ4_12_21S_10M	
Band Width	10MHz	10MHz	
FFT size	1024	1024	
UL Traffic Symbols	12	21	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QPSK R1/2	MCS : QAM64 R5/6	Single DIUC
Up link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QAM16 R3/4	MCS : QPSK R1/2	Single DIUC

Parameter /Value	Frame definition for 5MHz RCT		
	Test vector name		Remarks
	DQ4_12_UQ16_34_5M	DQ64_56_UQ4_12_5M	
Band Width	5MHz	5MHz	
FFT size	512	512	
UL traffic symbols	18	18	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS: QPSK R1/2	MCS : QAM64 R5/6	Single DIUC
Up link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS: QAM16 R3/4	MCS : QPSK R1/2	Single DIUC

16. SUMMARY OF SAR TEST RESULTS

Configuration	Antenna-to-User distance	SAR Require	Comment
Laptop mode: Lap-held	231.3 mm	No	This configuration does not require SAR assessment as the antenna-to-user separation distance is greater then 20 cm which meets the exemption requirement as indicated in FCC OET Bulletin 65 Supplement C: 2001-01.
Laptop mode: By Stander (nearby person)	-	No	This configuration does not require SAR assessment as the closest antenna-to-user configuration was covered by Edge Secondary Landscape' and is within 2.5 cm from By Stander.
Bottom Face	23.6 mm	Yes	SAR evaluation
Edge - Primary Landscape	211.18 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2), SAR is required only for the edge with the most conservative exposure conditions.
Edge - Secondary Landscape	2.0 mm	Yes	SAR evaluation This is the most conservative antenna-to-user distance at edge mode
Edge - Primary Portrait	180 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2), SAR is required only for the edge with the most conservative exposure conditions.
Edge - Secondary Portrait	95 mm	Yes	SAR measurements to be performed due to WiMax can simultaneous transmission with WWAN.

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16.1. Bottom Face

5 MHz Bandwidth

26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1 g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_56_UQ4_12_5M	37	2.70	2498.5	22.10	162.2	24.3	269.15			
				2593.0	22.20	166.0	24.3	269.15	1.43	0.017	**0.024**
				2687.5	22.10	162.2	24.3	269.15			
16QAM	DQ4_12_UQ16_34_5M	37	2.70	2498.5	22.40	173.8	24.3	269.15			
				2593.0	22.40	173.8	24.3	269.15	1.37	0.015	**0.020**
				2687.5	22.10	162.2	24.3	269.15			
64QAM	DQ4_12_UQ64_56_5M	37	2.70	2498.5	21.90	154.9	24.3	269.15			
				2593.0	21.90	154.9	24.3	269.15	1.53	0.001	**0.002**
				2687.5	21.90	154.9	24.3	269.15			

Note(s):

- Scale Factor for 26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]
- **"*cf*" = 1/(15/48) = 3.2 for 5 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).

10 MHz Bandwidth

23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_UQ4_12_21S_10M	43.2	2.31	2501.0	23.30	213.8	23.6	229.09			
				2593.0	22.90	195.0	23.6	229.09	0.86	0.022	**0.019**
				2685.0	22.60	182.0	23.6	229.09			
29:18 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*15)											
16QAM	DQ4_12_UQ16_12_10M	30.9	3.24	2501.0	22.90	195.0	23.6	229.09			
				2593.0	23.20	208.9	23.6	229.09	1.13	0.010	**0.011**
				2685.0	22.80	190.5	23.6	229.09			
23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)											
64QAM	DQ4_12_UQ64_56_10M	43.2	2.31	2501.0	20.50	112.2	23.6	229.09			
				2593.0	20.50	112.2	23.6	229.09	1.50	0.015	**0.023**
				2685.0	20.40	109.6	23.6	229.09			

Note(s):

- Scale Factor for 23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)]
  29:18 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*15)]
- **"*cf*" = 1/(12/48) = 4.0 for 10 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).
- SAR level measured was closed to noise floor due to device separation distance from the antenna-to-phantom flat section.

16.2. Edge - Secondary Landscape

5 MHz Bandwidth

26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1 g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_56_UQ4_12_5M	37	2.70	2498.5	22.10	162.2	24.3	269.15			
				2593.0	22.20	166.0	24.3	269.15	1.43	0.387	**0.554**
				2687.5	22.10	162.2	24.3	269.15			
16QAM	DQ4_12_UQ16_34_5M	37	2.70	2498.5	22.40	173.8	24.3	269.15			
				2593.0	22.40	173.8	24.3	269.15	1.37	0.371	**0.507**
				2687.5	22.10	162.2	24.3	269.15			
64QAM	DQ4_12_UQ64_56_5M	37	2.70	2498.5	21.90	154.9	24.3	269.15			
				2593.0	21.90	154.9	24.3	269.15	1.53	0.196	**0.301**
				2687.5	21.90	154.9	24.3	269.15			

Note(s):

- Scale Factor for 26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]
- **"*cf*" = 1/(15/48) = 3.2 for 5 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).
- SAR level measured was closed to noise floor due to device separation distance from the antenna-to-phantom flat section.

10 MHz Bandwidth

23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_UQ4_12_21S_10M	43.2	2.31	2501	23.30	213.8	23.6	229.09			
				2593	23.30	213.8	23.6	229.09	0.79	0.426	**0.335**
				2685	22.60	182.0	23.6	229.09			
29:18 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*15)											
16QAM	DQ4_12_UQ16_12_10M	30.9	3.24	2501	22.90	195.0	23.6	229.09			
				2593	23.20	208.9	23.6	229.09	1.13	0.272	**0.307**
				2685	22.80	190.5	23.6	229.09			
23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)											
64QAM	DQ4_12_UQ64_56_10M	43.2	2.31	2501	20.50	112.2	23.6	229.09			
				2593	20.50	112.2	23.6	229.09	1.50	0.249	**0.374**
				2685	20.40	109.6	23.6	229.09			

Note(s):

- Scale Factor for 23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)]
  29:18 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*15)]
- **"*cf*" = 1/(12/48) = 4.0 for 10 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).
- SAR level measured was closed to noise floor due to device separation distance from the antenna-to-phantom flat section.

16.3. Edge - Secondary Portrait

5 MHz Bandwidth

26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1 g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_56_UQ4_12_5M	37	2.70	2498.5	22.10	162.2	24.3	269.15			
				2593.0	22.20	166.0	24.3	269.15	1.43	0.133	0.190
				2687.5	22.10	162.2	24.3	269.15			

Note(s):

- Per SAR_RF_Exosure_Procedures_Updates_101910-KC, QPSK SAR is leas than 0.8 W/kg, 16QAM SAR is not needed.
- Scale Factor for 26:21 UL:DL Ratio = [(Max. Rated pwr*5/17*3) + (Max. Rated pwr*15)] / Actual pwr*18)]
- **"*cf*" = 1/(15/48) = 3.2 for 5 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).
- SAR level measured was closed to noise floor due to device separation distance from the antenna-to-phantom flat section.

10 MHz Bandwidth

23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)]

Mode	Test vector file name	Calculated		Freq. (MHz)	Output power				Scale Factors	1g SAR (W/kg)	
		Duty Cycle (%)	Crest Factor		Actual		Max. Rated			Measured	Scaled
					dBm	mW	dBm	mW			
QPSK	DQ64_UQ4_12_21S_10M	43.2	2.31	2501	23.30	213.8	23.6	229.09			
				2593	23.30	213.8	23.6	229.09	0.79	0.209	0.165
				2685	22.60	182.0	23.6	229.09			

Note(s):

- Per SAR_RF_Exosure_Procedures_Updates_101910-KC, QPSK SAR is leas than 0.8 W/kg, 16QAM SAR is not needed.
- Scale Factor for 23:24 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*21)]
  29:18 UL:DL Ratio = [(Max. rated pwr*5/35*3) + (max. rated pwr*15)] / Actual pwr*15)]
- **"*cf*" = 1/(12/48) = 4.0 for 10 MHz**
- SAR test was performed in the middle channel only as the measured level was < 5% of the SAR limit (1.6W/kg).
- SAR level measured was closed to noise floor due to device separation distance from the antenna-to-phantom flat section.

17. WORST-CASE SAR PLOTS

Worst-case SAR Test Plot

Date/Time: 2/9/2011 8:13:14 PM

Test Laboratory: UL CCS

Secondary Landscape

DUT: Lenovo; Type: Comet Tablet; Serial: R9-8V2Y 10/11

Communication System: WiMAX 2.6GHz 5M; Frequency: 2593 MHz;Duty Cycle: 1:3.20627
Medium parameters used (interpolated): f = 2593 MHz; σ = 2.166 mho/m; ε_r = 51.916; ρ = 1000 kg/m^3
Phantom section: Flat Section

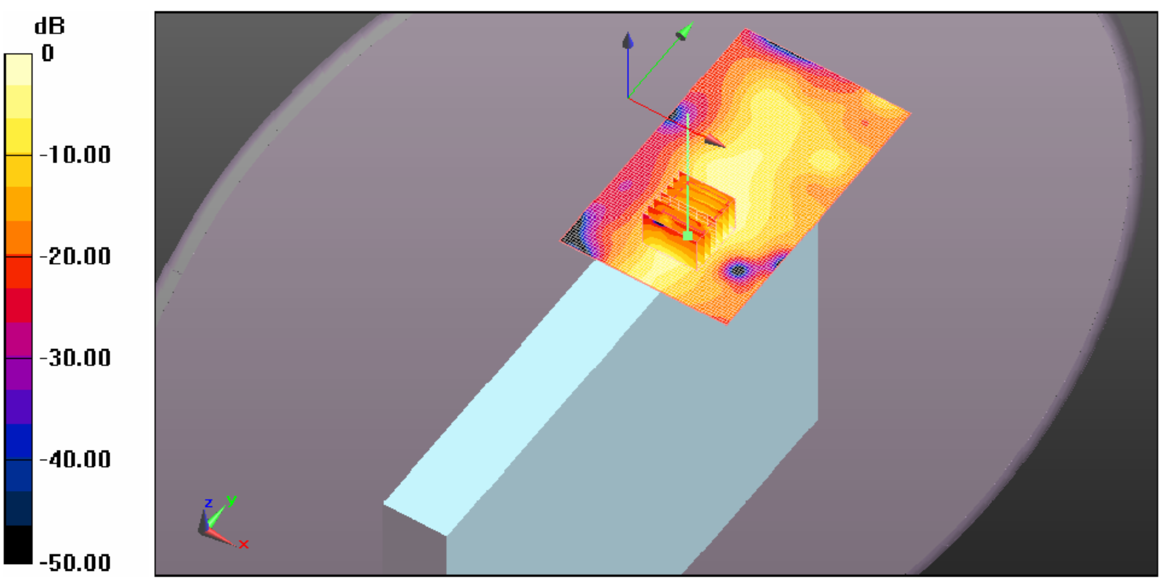
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.78, 6.78, 6.78); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1239; Calibrated: 11/17/2010
- Phantom: ELI 4.0; Type: QDOVA001BB; Serial: 1099
- Measurement SW: DASY52, Version 52.6 (1);SEMCAD X Version 14.4.2 (2595)

5M_QPSK/ch_378/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.587 mW/g

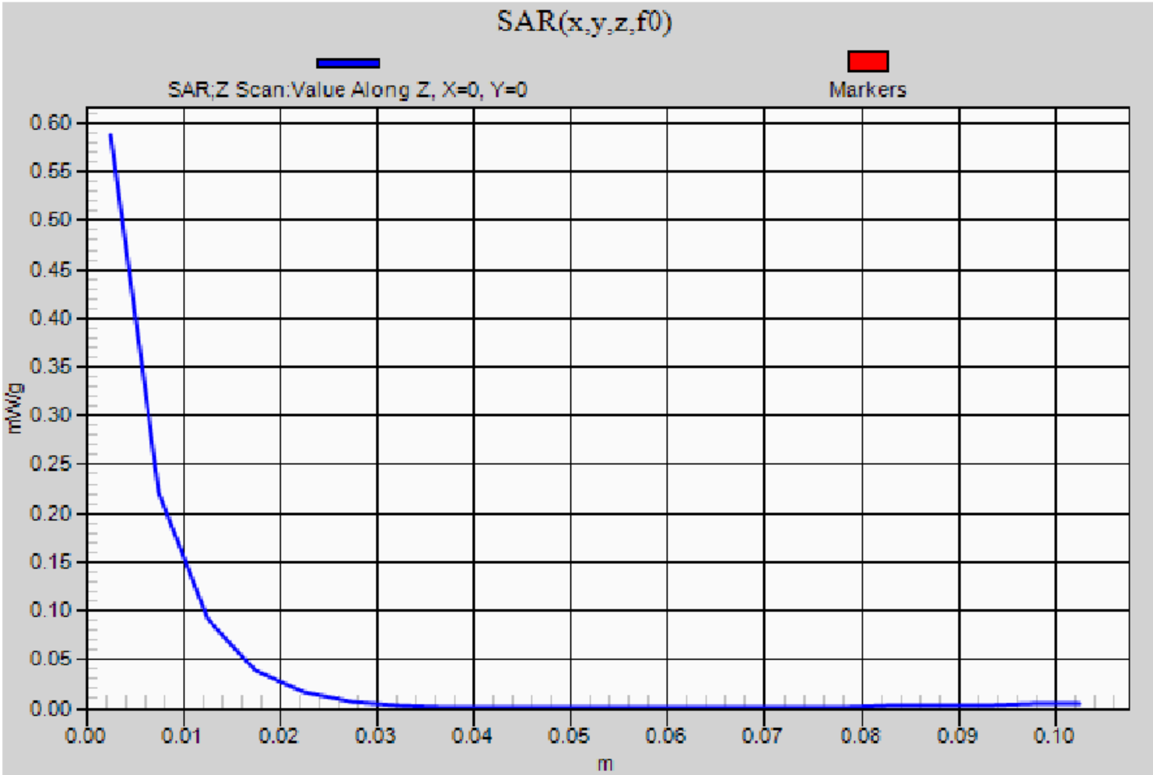
5M_QPSK/ch_378/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 17.353 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.629 W/kg
SAR(1 g) = 0.387 mW/g; SAR(10 g) = 0.146 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.741 mW/g

5M_QPSK/ch_378/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.642 mW/g



0 dB = 0.640mW/g

Z-Axis Plot


SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
mW/g
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
m

18. PAR AND SAR ERROR CONSIDERATION

In order to estimate the measurement error due to PAR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from approximately 12.5 mW at approx. 3 dB steps, until the maximum power is reached.

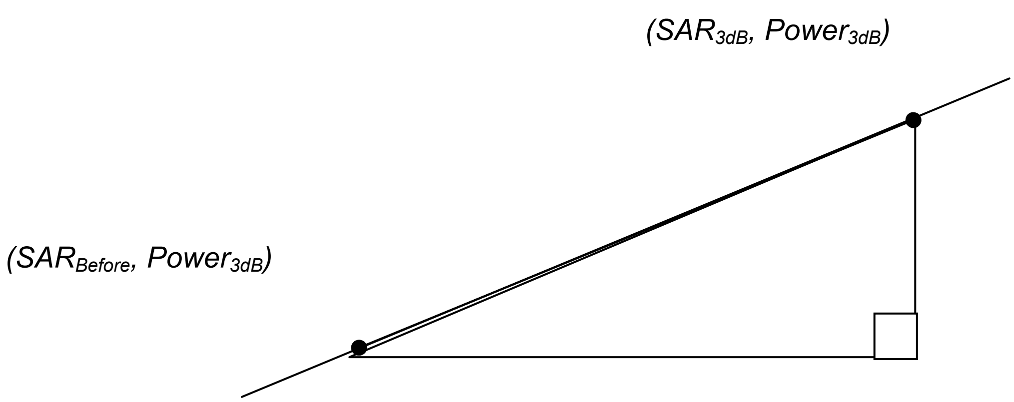
In order to estimate the measurement error due to PAR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from approximately 10 mW at approx. 3 dB steps, until the maximum power is reached.

Procedure:
1) Position the EUT at flat phantom with 0 cm separation distance (Secondary landscape). **(w/ 2.0 mm distance from WiMax main antenna-to-phantom)**
2) Perform single point SAR evaluation with EUT power to be tuned at 10 - 15 mW.
3) Record the highest single point SAR value for each power setting as indicated above.
4) Without changing probe and EUT position increase the EUT power by 3 dB steps.

Assumption:
1. First single point SAR at power = 0 mW the SAR = 0 W/kg
2. SAR is linear to power only when the measurement probe sensors are operating within the square-law region.

Linear Line:
The actual measure output power has an tolerance due to the accuracy of the power sensors, RF cable and attenuator therefore the measure power will exhibited a +/- 0.05 % error. When power is set to 10 mW and SAR value "*x*" is known the next value on the Linear Line at approximately 3 dB up can be calculated as follow:

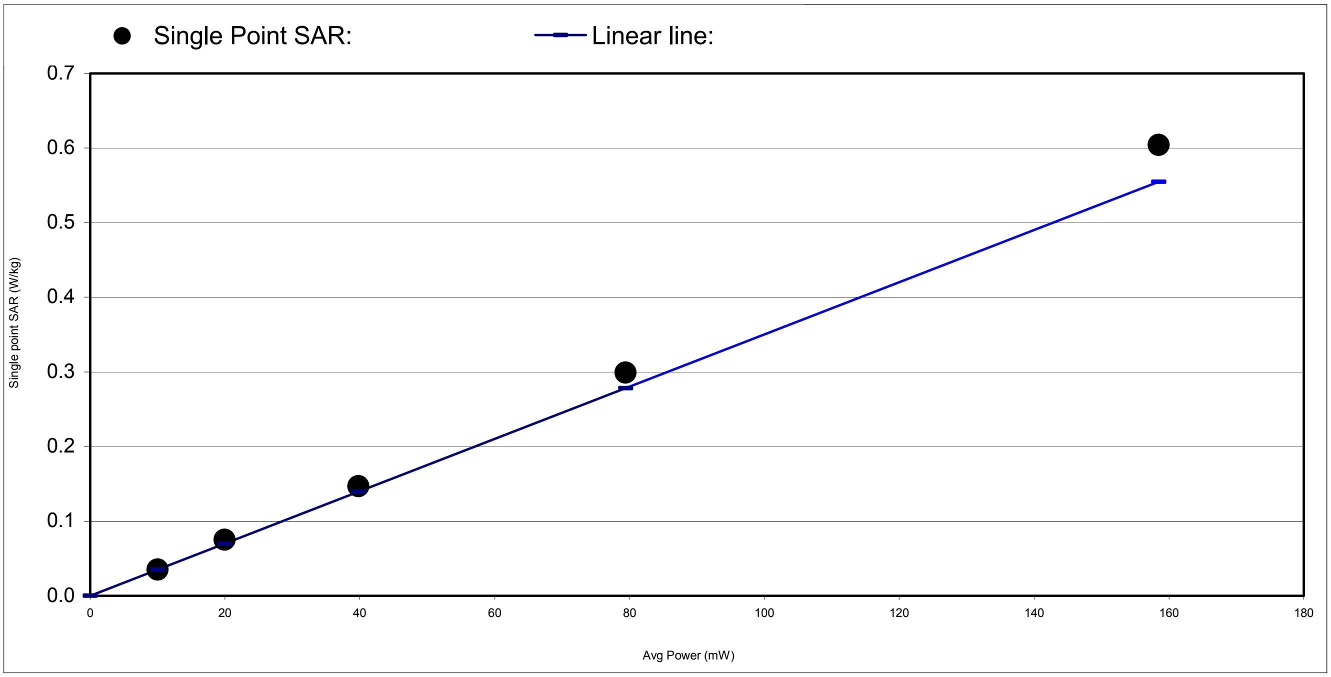
$SAR_{3dB} = (SAR_{Before} \times Power_{3dB}) / Power_{Before}$



Measurement Result for 5 MHz, QPSK

5M_QPSK

Average Power (dBm):	10	13	16	19	22
Average Power (mW):	10.0	20.0	39.8	79.4	158.5
Single Point SAR:	**0.035**	**0.075**	**0.147**	**0.299**	**0.604**
Linear line:	**0.035**	**0.070**	**0.139**	**0.278**	**0.555**
Estimated (%):	0.000	7.397	5.499	7.548	8.885



Procedure in establishing linear line (SAR):

- First reference Point = 0 when power = 0
- Second reference Point: 0.035 W/kg @ 10 mW
- Third reference point: (0.035*20)/10 = 0.07
- Fourth reference point: (0.07*39.8)/20 = 0.139
- Fifth h reference point: (0.139*79.4)/39.8 = 0.278
- Sixth reference point: (0.278*158.5)/79.4= 0.555

Draw a reference line from first reference point to sixth reference point

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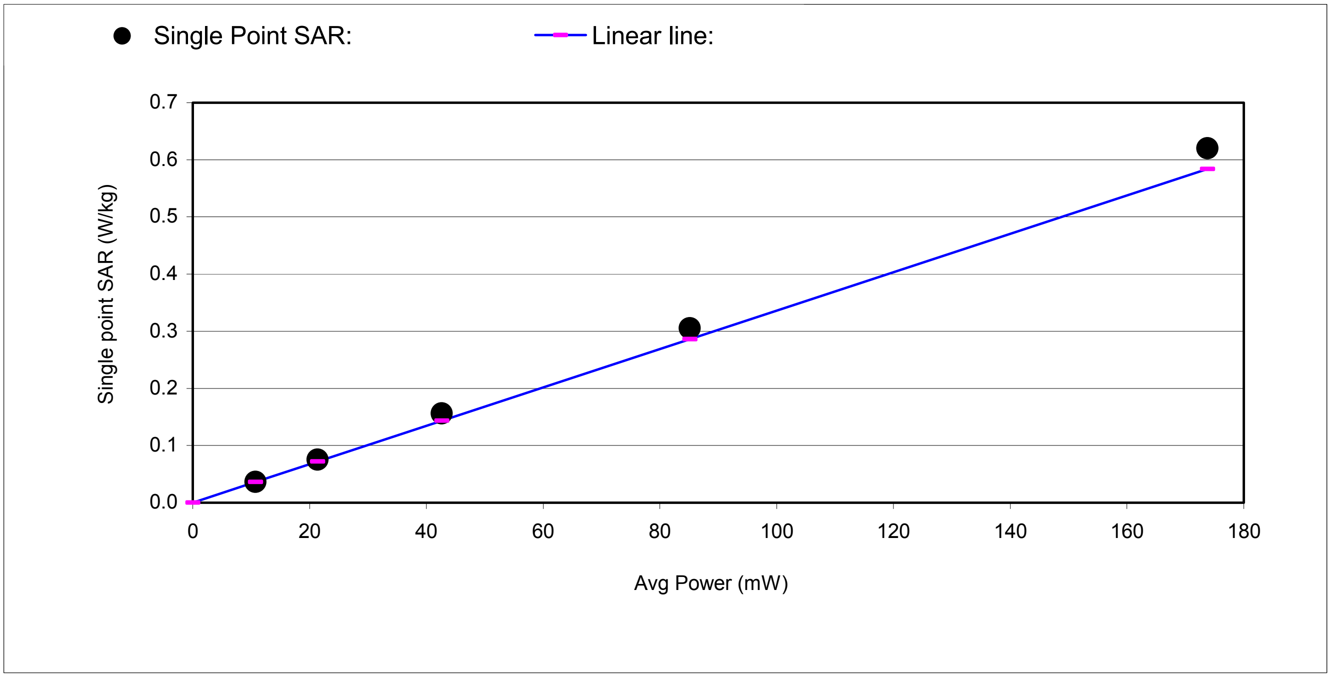
Measurement Result for 5 MHz, 16QAM

5M_16QAM					
Average Power (dBm):	10.3	13.3	16.3	19.3	22.4
Average Power (mW):	10.7	21.4	42.7	85.1	173.8
Single Point SAR:	**0.036**	**0.075**	**0.156**	**0.305**	**0.620**
Linear line:	**0.036**	**0.072**	**0.143**	**0.286**	**0.584**
Estimated (%):	0.000	4.414	8.848	6.659	6.191



Procedure in establishing linear line (SAR):

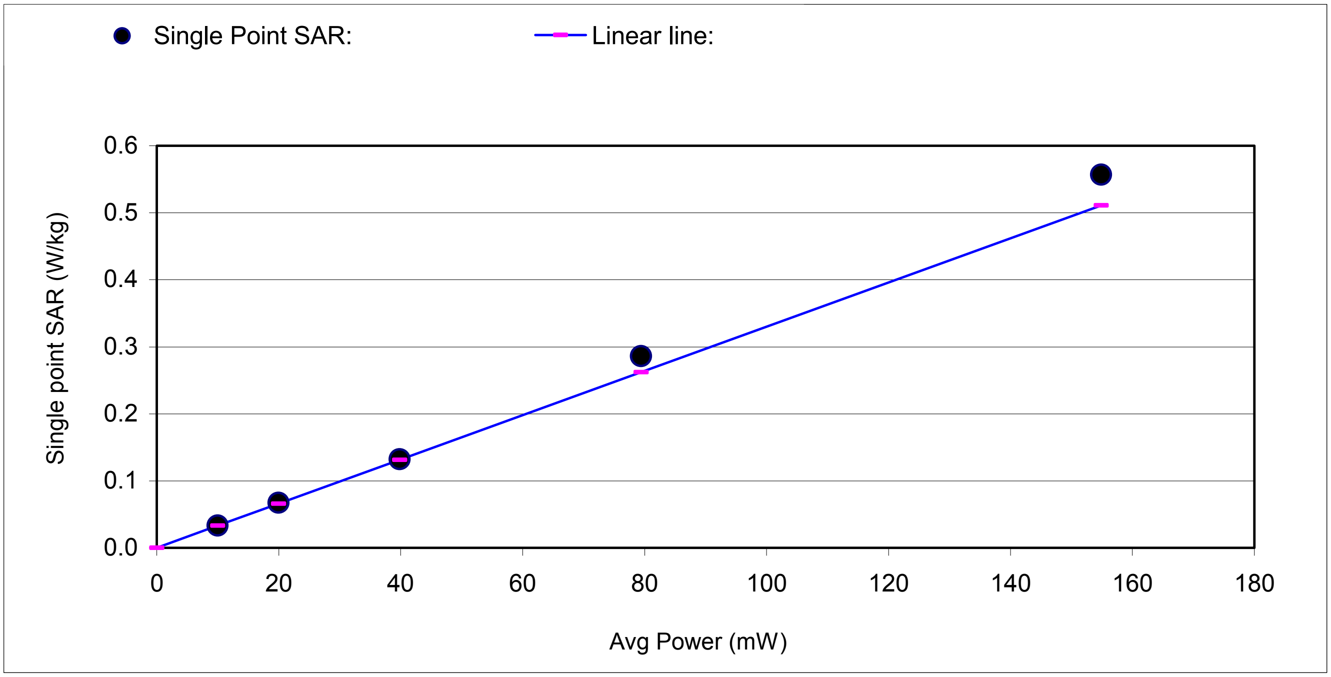
- First reference Point = 0 when power = 0
- Second reference Point: 0.036 W/kg @ 10.7 mW
- Third reference point: (0.036*21.4)/10.7 = 0.072
- Fourth reference point: (0.072*42.7)/21.4 = 0.143
- Fifth h reference point: (0.143*85.1)/42.7 = 0.286
- Sixth reference point: (0.286*173.8)/85.1= 0.584

Draw a reference line from first reference point to sixth reference point

Measurement Result for 5 MHz, 64QAM

5M_64QAM

Average Power (dBm):	10	13	16	19	21.9
Average Power (mW):	10.0	20.0	39.8	79.4	154.9
Single Point SAR:	**0.033**	**0.067**	**0.132**	**0.286**	**0.557**
Linear line:	**0.033**	**0.066**	**0.131**	**0.262**	**0.511**
Estimated (%):	0.000	1.756	0.475	9.107	8.979



Procedure in establishing linear line (SAR):

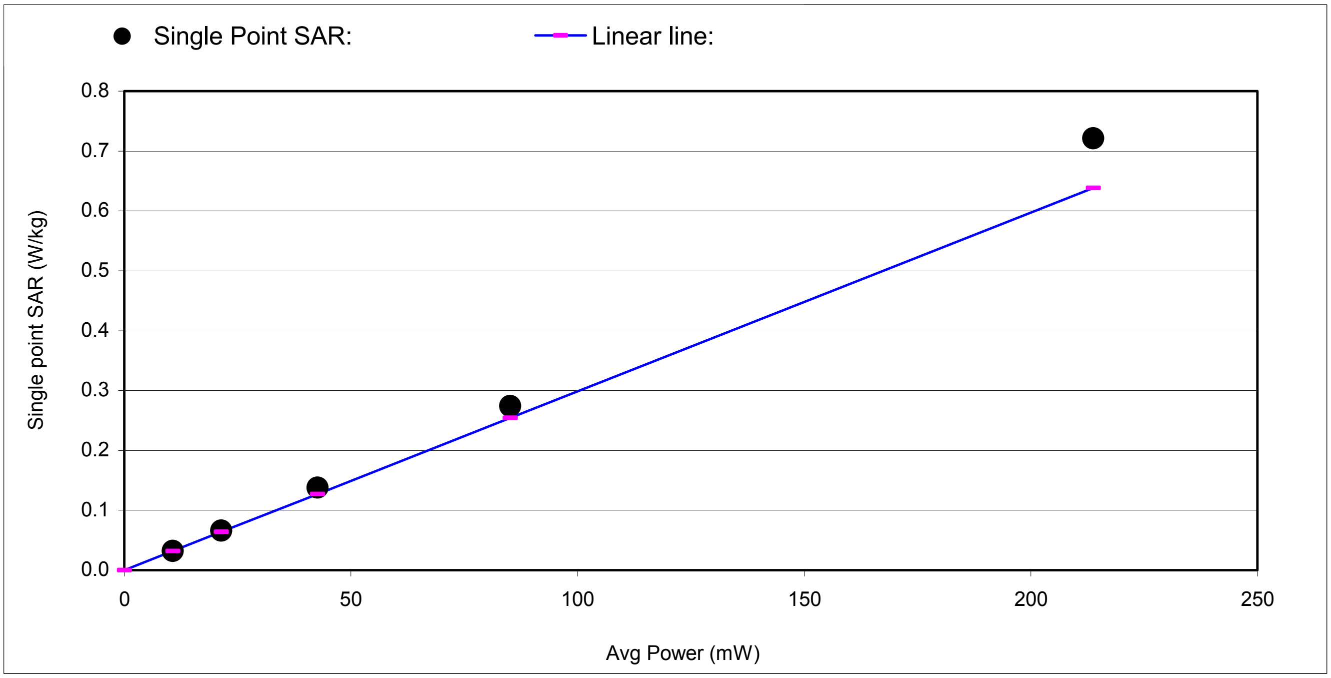
- First reference Point = 0 when power = 0
- Second reference Point: 0.033 W/kg @ 10 mW
- Third reference point: (0.033*20)/10 = 0.066
- Fourth reference point: (0.066*39.8)/20 = 0.131
- Fifth h reference point: (0.131*79.4)/39.8 = 0.262
- Sixth reference point: (0.262*154.9)/79.4 = 0.511

Draw a reference line from first reference point to sixth reference point

Measurement Result for 10 MHz, QPSK

10M_QPSK

Average Power (dBm):	10.3	13.3	16.3	19.3	23.3
Average Power (mW):	10.7	21.4	42.7	85.1	213.8
Single Point SAR:	**0.032**	**0.066**	**0.138**	**0.274**	**0.721**
Linear line:	**0.032**	**0.064**	**0.127**	**0.254**	**0.638**
Estimation (%):	0.000	3.370	8.325	7.795	12.924



Procedure in establishing linear line (SAR):

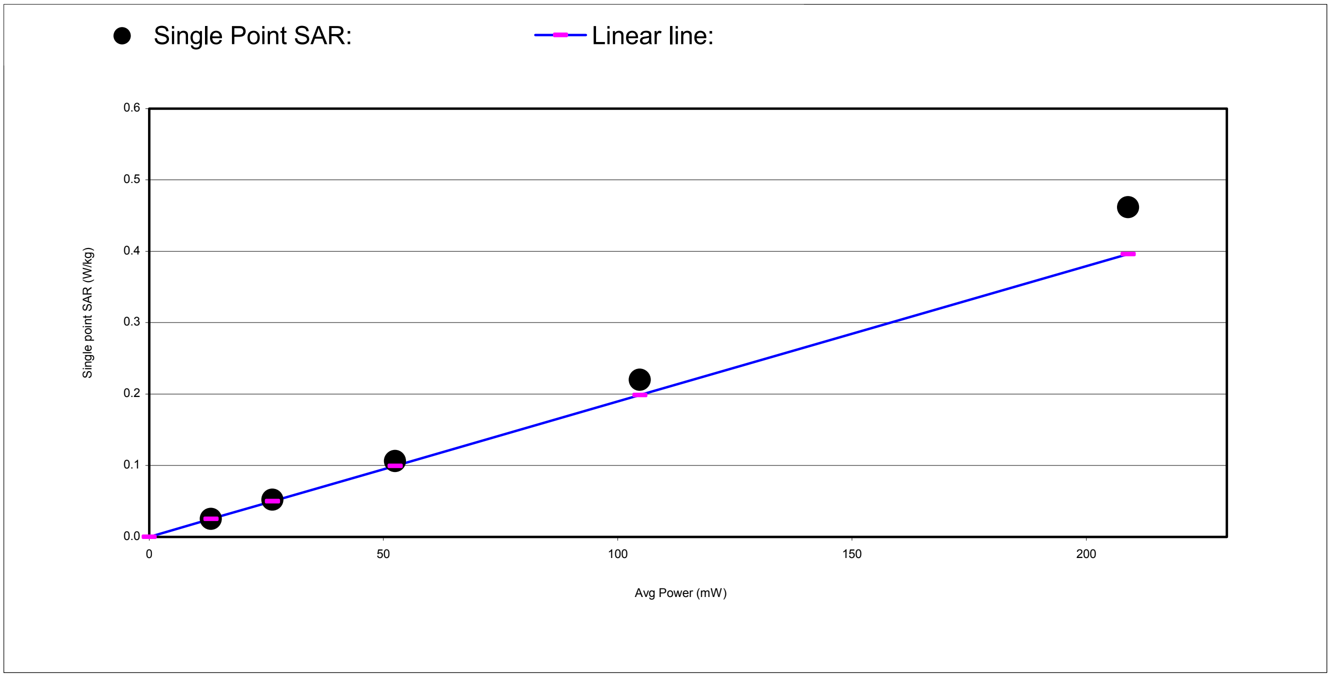
- First reference Point = 0 when power = 0
- Second reference Point: 0.032 W/kg @ 10 mW
- Third reference point: (0.032*21.4)/10.7 = 0.064
- Fourth reference point: (0.066*42.7)/21.4 = 0.127
- Fifth h reference point: (0.127*85.1)/42.7 = 0.254
- Sixth reference point: (0.254*213.8)/85.1 = 0.638

Draw a reference line from first reference point to sixth reference point.

Measurement Result for 10 MHz, 16QAM

10M_16QAM

Average Power (dBm):	11.2	14.2	17.2	20.2	23.2
Average Power (mW):	13.2	26.3	52.5	104.7	208.9
Single Point SAR:	**0.025**	**0.052**	**0.106**	**0.220**	**0.462**
Linear line:	**0.025**	**0.050**	**0.100**	**0.199**	**0.396**
Estimation (%):	0.000	4.247	6.504	10.785	16.601



Procedure in establishing linear line (SAR):

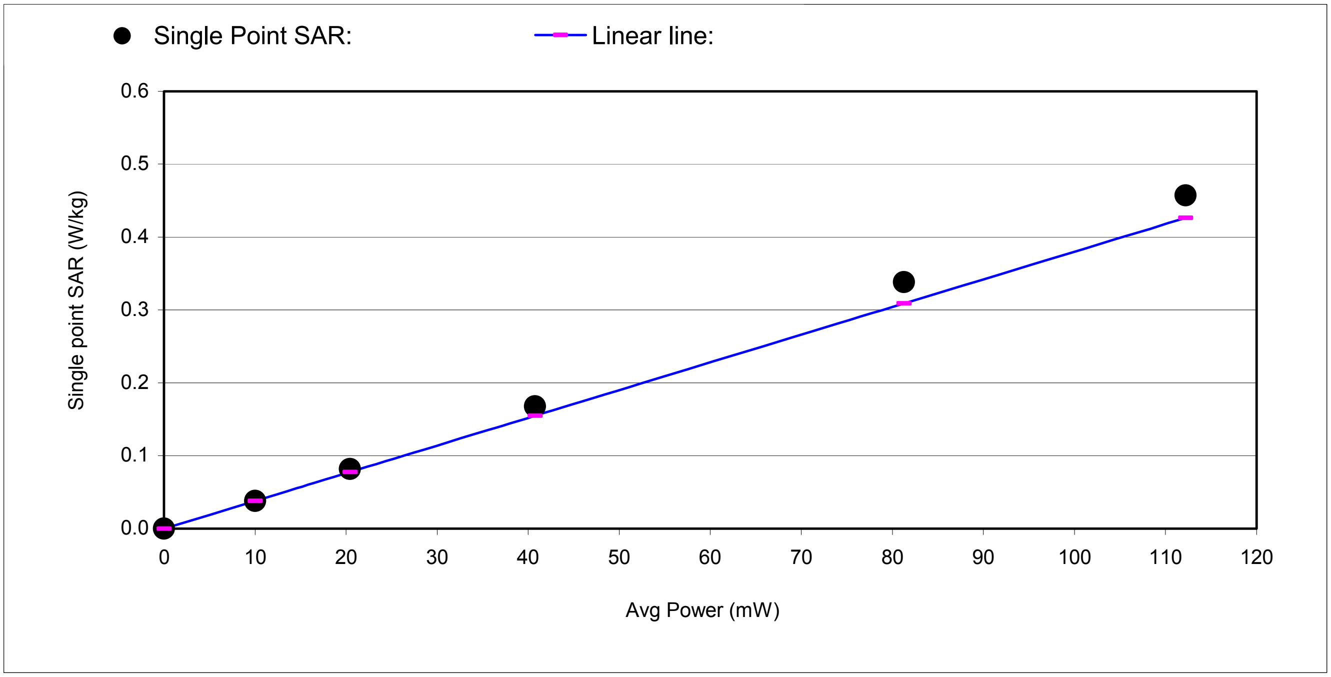
- First reference Point = 0 when power = 0
- Second reference Point: 0.025 W/kg @ 13.2 mW
- Third reference point: (0.025*26.3)/13.2 = 0.050
- Fourth reference point: (0.050*52.5)/26.3 = 0.100
- Fifth h reference point: (0.100*104.7)/52.5 = 0.199
- Sixth reference point: (0.199*208.9)/104.7 = 0.396

Draw a reference line from first reference point to sixth reference point.

Measurement Result for 10 MHz, 64QAM

10M_64QAM

Average Power (dBm):	10	13.1	16.1	19.1	20.5
Average Power (mW):	10.0	20.4	40.7	81.3	112.2
Single Point SAR:	**0.038**	**0.082**	**0.168**	**0.338**	**0.457**
Linear line:	**0.038**	**0.078**	**0.155**	**0.309**	**0.426**
Estimation (%):	0.000	5.689	8.524	9.429	7.185



Procedure in establishing linear line (SAR):

- First reference Point = 0 when power = 0
- Second reference Point: 0.038 W/kg @ 10 mW
- Third reference point: (0.038*20.4)/10 = 0.078
- Fourth reference point: (0.078*40.7)/20.4 = 0.155
- Fifth h reference point: (0.155*81.3)/40.7 = 0.309
- Sixth reference point: (0.309*112.2)/81.3 = 0.426

Draw a reference line from first reference point to sixth reference point.

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19. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Check Plots D2600V2 SN 1006	6
2	SAR Test Plots	18
3	Certificate of E-Field Probe EX3DV3 SN 3686	11
4	Certificate of System Validation Dipole D2600V2 SN:1006 (with extended calibration verification data)	7